

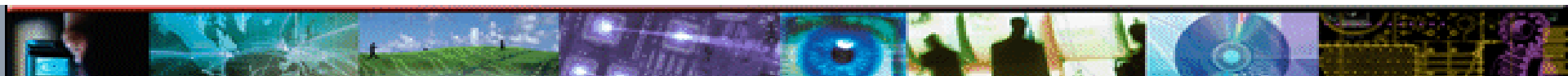
Anti-Corrosion Nanotechnology Solutions for DoD Applications

2010 U.S. Army Corrosion Summit

Dr. Lars Ericson

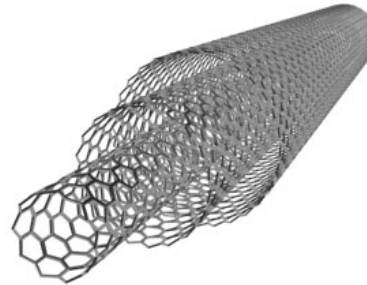
(Principal Scientist, ManTech e-IC)

February 11th, 2010; Huntsville, AL



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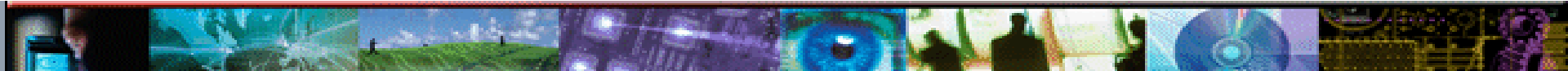
- Project Overview
- Nanotechnology
CPC Applications
- Current Activities
w/ OH-58D Kiowa Warrior



Source: Akasaka



Source: TC Lin - poagao.com



Anti-Corrosion Nanotechnology Solutions – Logistics (ACNS-L) Project

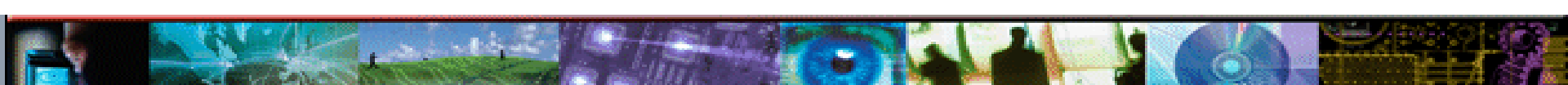
Customer: USA Logistics Innovation Agency (LIA)

Overarching Goal is to develop...

- A **structured approach to nanotechnology solutions** that will assist Army future forces to overcome corrosion problems

Currently...

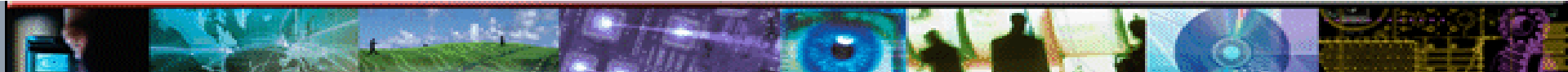
- Working with OH-58D Kiowa Warrior PMO to develop a **Nanotechnology Corrosion Mitigation Plan (NCMP)**



Nanotech Corrosion R&D Assessment Report

- **Assess** state of nanotech corrosion mitigation R&D
- **Report** on major areas of nanotech corrosion mitigation
- **Detail** existing and emerging nanotechnology-enabled commercial products for corrosion mitigation
- **Summarize** conventional corrosion mitigation techniques and products
- **Identify** key organizations and research groups involved in nanotechnology corrosion mitigation

COMPLETE



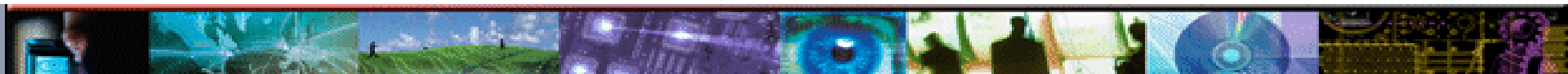
“Nanotechnology is the understanding and control of matter at dimensions of roughly **1 to 100 nanometers**, where unique phenomena enable novel applications”

- By 2014, impact about 15% of total global output
 - \$2.6T manufactured goods will incorporate nanotech
 - Army leverage economies of scale
- Aspects of Nanotechnology
 - Manipulation of matter at the nanoscale
 - Interdisciplinary
 - Unique and enhanced properties

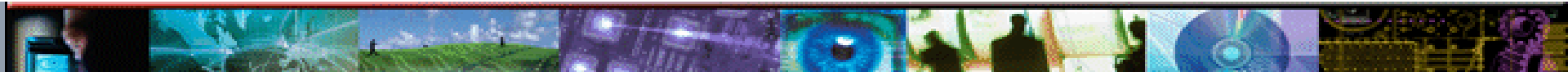
Quantum Dots



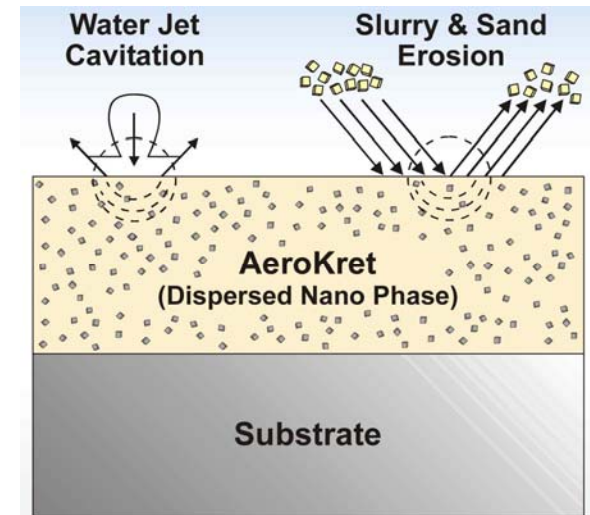
Source: Koninklijke Philips Electronics N.V.



Nanotech CPC Applications



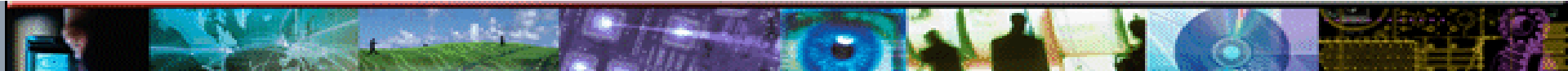
- **AeroKret (Analytical Services & Materials)** – Hybrid inorganic-organic elastomeric nanocoating system (primer + topcoat) designed for erosion, corrosion, and cavitation protection.



Source: AS&M

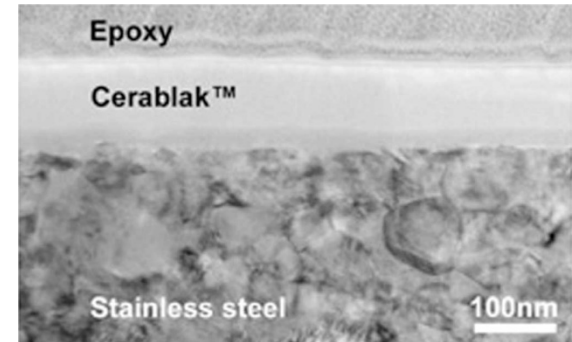
- **Bonderite NT-1 & TecTalis (Henkel Technologies)** – Nanostructured zirconium oxide conversion coating developed as an alternative to heavy metal phosphate-based conversion coatings.

Products have not been tested or endorsed by ManTech or USA LIA

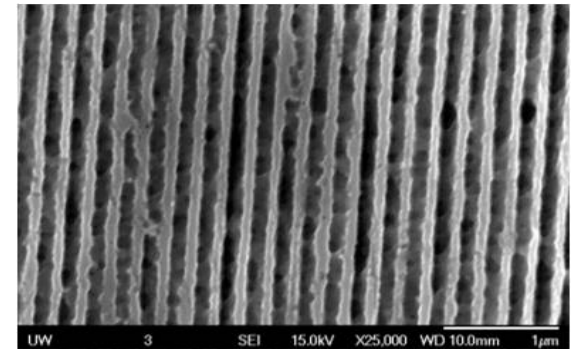


Nanotech CPC Applications (cont.)

- **High Performance Ceramic Coatings (*HiPerCoat, Cerablak*)** – High temperature oxidative protection of equipment (e.g. engine, exhaust, turbine).
- **Nanolaminate Plating (*Modumetal Inc.*)** – Enhanced mechanical and corrosion protection; Replacement for chromium and cadmium plating.

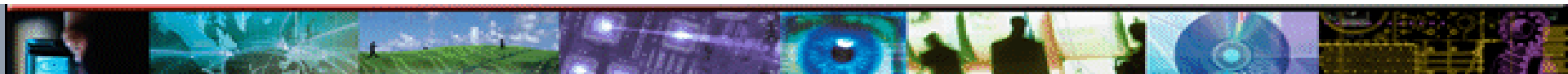


Source: Applied Thin Films Inc.



Source: Modumetal

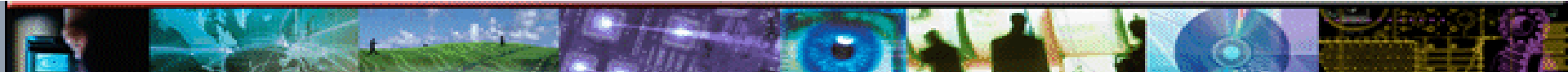
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Nanotech CPC Applications (cont.)

- **Nano Ceramic Thermal Spray Coating** – Robust, dense coatings with enhanced wear resistance.
 - A&A Co., Inframat Corp., Perpetual Technologies
- **Nanomyte (American Nanomyte)** – Non-chromate nanomaterial barrier pre-treatments for enhanced protection of aluminum, magnesium, and steel alloys.
- **Zyvere (Nanovere)** – Nanocomposite topcoat fluoropolymer with excellent wear, erosion, and corrosion resistance for steel substrates.

Products have not been tested or endorsed by ManTech or USA LIA



Nanotech CPC Applications (cont.)

- **Nanostructured Metal Plating (The NanoSteel Co., Integran Technologies)** – High performance metal alloy alternatives to heavy metal corrosion protection plating, such as chromium.
- **QwikSeal Pre-Loaded Fastener (SMRC)** – Fastener with pre-loaded cure-blocked sealant for efficient installation and enhanced galvanic protection.

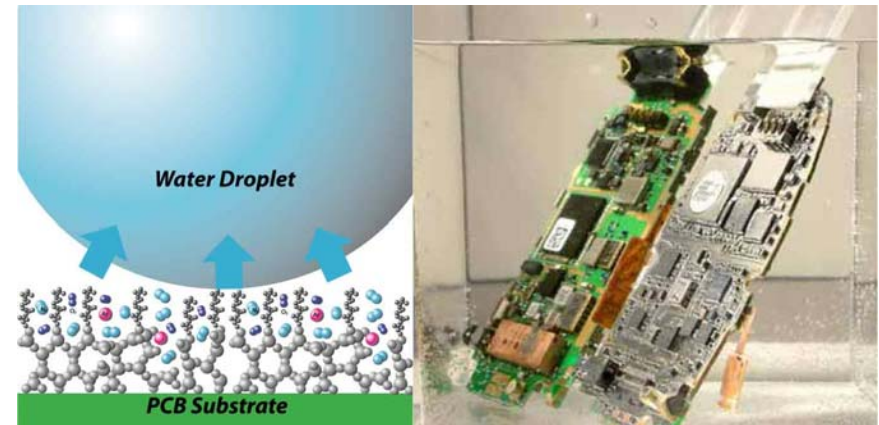


Source: Systems & Materials Research Corporation

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Nanotech CPC Applications (cont.)

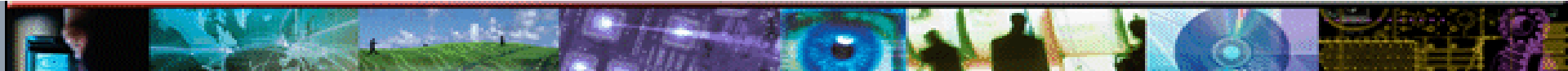
- **Repellix (Integrated Surface Technologies)** – Superhydrophobic aerogel coating for protecting printed electronic circuit boards.



Source: Integrated Surface Technologies

- **Teslan (Tesla Nanocoatings)** – Carbon nanotube polymer composite zinc-rich primer with enhanced sacrificial and barrier properties.
 - See ACS2009 Drozd (ERDC) Presentation for more info

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Nanotech CPC

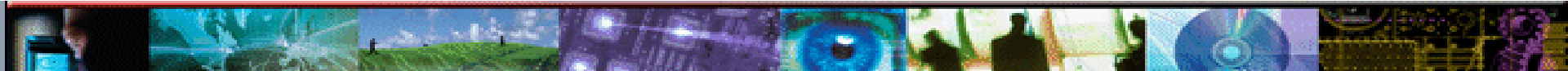
Near-Future Focus

- **Nanomaterial Inhibitor Coatings** – Nanomaterials as carriers for corrosion inhibitors in protective coatings.
 - PPG Aerospace (*Desoprime CA7502*), Luna Innovations, TDA Research
- **Superhydrophobic Coatings** – Efficiently repel water; Promising prototype coating uniquely facilitated by nanotechnology.
 - Luna Innovations, Resodyn Corp., Ross Technology, Seashell Technologies

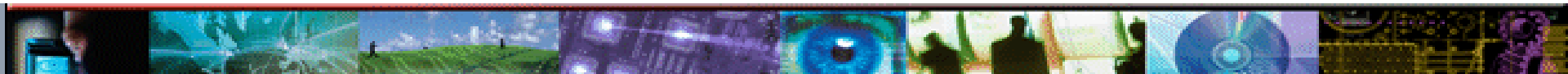


Source: Resodyn Corporation

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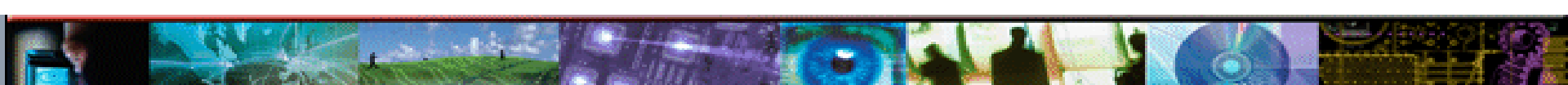
Current ACNS-L Activities



ACNS-L Project Phases

- **Phase 1 – Foundational Assessments (2009)**
 - Nanotechnology Corrosion R&D Assessment
 - Army Corrosion Assessment **COMPLETE**
- **Phase 2 – Strategy & Logistics (2010)**
 - Technical/Business Case Analysis **IN PROGRESS**
 - Nanotechnology Corrosion Mitigation Plan
- **Phase 3 – Testing & Implementation (2011)**
 - T&E of Nanotechnology Corrosion Solutions **PLANNED**
 - Subtopic Analysis

Goal → Tangible benefits for Army corrosion mitigation



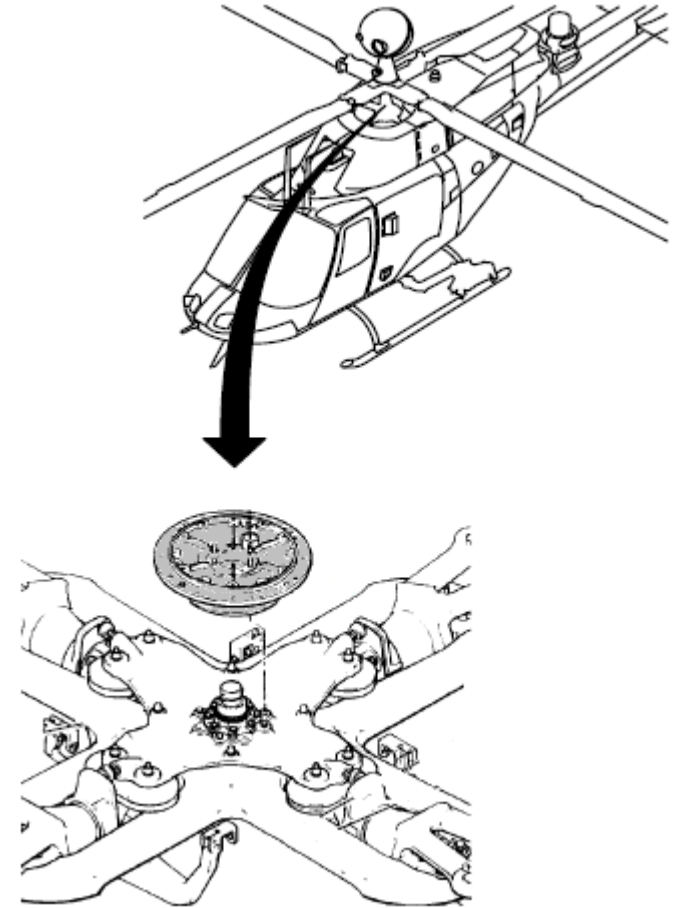
OH-58D Torquemeter Support

OH-58D Kiowa Warrior

- Service Life extended to 2025
- Major Modification in FY13

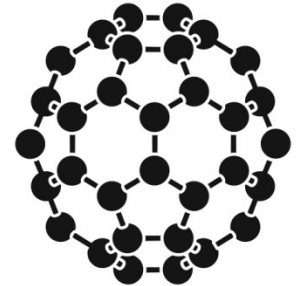
Torquemeter Support

- Supports mast-mounted sight
- 7075-T73 AA
- Exterior primer + CARC
- Suffering from pitting corrosion
 - During RESET 8/8 replaced



Anti-Corrosion Nanotechnology Solutions – Logistics (ACNS-L)

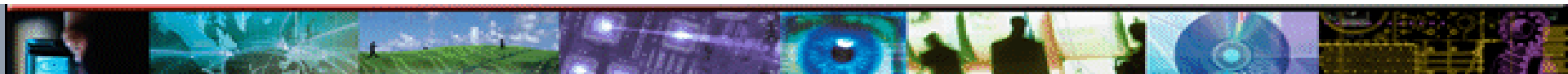
- USA LIA Project
- Promising nanotech CPC solutions for DoD
 - Nanotech Corrosion R&D Assessment Report
- Developing NCMP for OH-58D Kiowa Warrior



Source: ManTech e-IC



Source: Darren Hester (Flickr)



Thank You!

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